Derivatives 2014-10-20 day 38

3.4/18 $f(x) = \dfrac{\boxed{(x^2+1)\cot x}}{\boxed{3-\cos x\csc x}}$

$$f'(x) = \frac{\frac{d}{dx}\left[(x^2+1)\cot x\right](3-\cos x\csc x) - (x^2+1)\cot x\,\frac{d}{dx}(3-\cos x\csc x)}{(3-\cos x\csc x)^2}$$

$$= \frac{\left[\frac{d}{dx}(x^2+1)\cdot\cot x + (x^2+1)\frac{d}{dx}(\cot x)\right](3-\cos x\csc x) - (x^2+1)\cot x\left[\frac{d}{dx}(\cos x)\cdot\csc x + \cos x\frac{d}{dx}(\csc x)\right]}{(3-\cos x\csc x)^2}$$

$$\frac{\left[(2x)\cot x + (x^2+1)(-\csc^2 x)\right](3-\cos x\csc x) - (x^2+1)\cot x\left[(-\sin x)\csc x + \cos x(-\csc x\cot x)\right]}{(3-\cos x\csc x)^2}$$

$$\frac{\cancel{6x\cot x} - 3(x^2+1)\csc^2 x - \cancel{2x\cot x}\cos x\csc x + (x^2+1)\cos x\csc^3 x + (x^2+1)\sin x\cot x\csc x + (x^2+1)\cos x\csc x\cot^2 x}{(3-\cos x\csc x)^2}$$

$$= \frac{2x\cot x(3-\cos x\csc x) + (x^2+1)\left[-3\csc^2 x + \cos x\csc^3 x + \sin x\cot x\csc x + \cos x\csc x\cot^2 x\right]}{(3-\cos x\csc x)^2}$$

$$= \frac{2x\cot x(3-\cos x\csc x) + (x^2+1)\left[-3\csc^2 x + \cot x\csc^2 x + \cot x + \cot^3 x\right]}{(3-\cos x\csc x)^2}$$

$$\frac{\sin^2}{\sin^2} + \frac{\cos^2}{\sin^2} = \frac{1}{\sin^2}$$

$$1 + \cot^2 = \csc^2$$

$-3\csc^2 x + \cot x\left[\csc^2 x + 1 + \cot^2 x\right]$

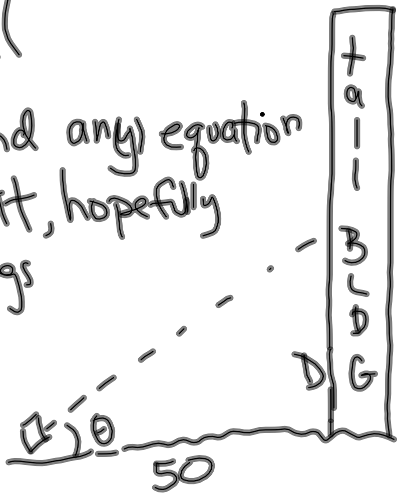
$-3\csc^2 x + \cot x\left[2\csc^2 x\right]$

$= \csc^2 x(-3 + 2\cot x)$

Derivatives 2014-10-20 day 38

33) find $\frac{dD}{d\theta}$

aha! I need to find any equation with D and θ in it, hopefully with no other things that are changing or I don't know.



$$\tan\theta = \frac{D}{50} = \frac{1}{50}D$$ → take derivative wrt θ

$$\sec^2\theta = \frac{1}{50}\frac{dD}{d\theta}$$ derivative equation, solve for $\frac{dD}{d\theta}$

$$\boxed{50\sec^2\theta = \frac{dD}{d\theta}}$$ at θ=45°

$$50\frac{1}{\cos^2(45°)} = \frac{dD}{d\theta} = 50\left(\frac{1}{\left(\frac{\sqrt{2}}{2}\right)^2}\right) = 50\left(\frac{1}{\frac{1}{2}}\right)$$

$$= 100 \frac{\text{meters}}{1\text{ radian}} \frac{1}{\left(\frac{180}{\pi}\right)}$$

$$= \frac{100\pi}{180} \frac{m}{\text{degree}}$$

if θ = θ(t), then we need 3.6 IMPLICIT DIFFERENTIATION
3.7 RELATED RATES.

Mackensie
Kathryn
Uma
Alexa

(Project) due after Thanksgiving

(Homework) 1-47 in section 3.7

(Taku) (d3wa)

Derivatives

2014-10-20 day 38

3.4/19) $y = x\cos x$ find $\frac{d^2y}{dx^2}$ $[f''(x)]$

$$y' = \frac{dy}{dx} = \boxed{\frac{d}{dx}(x)}\cdot\cos x + x\frac{d}{dx}(\cos x)$$

differential (derivative) operator

$$= \cos x + x(-\sin x)$$

$$\frac{dy}{dx} = \cos x - x\sin x$$

$$y'' = \frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right) = (-\sin x) - \left[\frac{d}{dx}(x)\cdot\sin x + x\frac{d}{dx}(\sin x)\right]$$

$$= -\sin x - [\sin x + x(\cos x)]$$

$$= -\sin x - \sin x - x\cos x$$

$$= -2\sin x - x\cos x = -(2\sin x + x\cos x)$$

+ is an additive operator (needs 2 things)

Derivatives 2014-10-20 day 38

3.4/24) $y = \tan x$ find $\frac{d^2y}{dx^2}$

$$y' = \frac{dy}{dx} = \sec^2 x = (\sec x)(\sec x)$$

$$y'' = \frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{d}{dx}(\sec^2 x)$$

$$= \frac{d}{dx}\left((\sec x)(\sec x)\right)$$

$$= \frac{d}{dx}(\sec x) \cdot \sec x + \sec x \frac{d}{dx}(\sec x)$$

$$= (\sec x \tan x)\sec x + \sec x(\sec x \tan x)$$

$$= 2\sec^2 x \tan x$$

Using Bob's chain rule

$$\frac{d}{dx}(f(g(x))) = f'(g(x)) \cdot g'(x)$$

$x \to \sec x \mapsto (\ )^2$

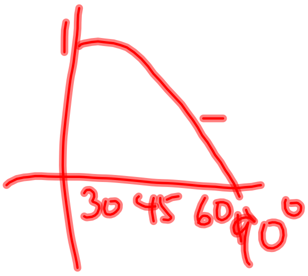
$$\frac{d}{dx}(\sec^2 x) = 2(g(x))^1 \cdot g'(x)$$

$$= 2(\sec x) \cdot \frac{d}{dx}(\sec x)$$

$$= 2\sec x \cdot (\sec x \tan x)$$

Derivatives 2014-10-20 day 38

$\cos 60 = \frac{1}{2}$



1

$\frac{\sqrt{3}}{2}$

$\frac{\sqrt{2}}{2}$

$\frac{\sqrt{1}}{2}$ ←

0